INTRODUCTION

Early in the next century, Queensland will overtake Victoria in terms of economic influence and population and become second only to New South Wales as a sub-national economy. While the analysis of State economies cannot be made independently of the national economy, particularly in terms macro-aggregates such as interest rates it is also clear that differences between the States in economic outcomes exist and tend to persist over extended time periods. For example, for most of the last two decades, unemployment has been concentrated in Tasmania and South Australia, Queensland has had the highest employment growth and Western Australia and Queensland have exhibited above average growth rates. Economic activity does differ across Australia and because of this it is essential for economic models at the state and regional level to be developed and applied.

In Queensland, apart from a few notable but isolated efforts by private consultants and academics, the major initiatives in economic modelling has been undertaken by staff at Queensland Treasury which, at present, maintains and operates several forms of modelling capacity. These are The Queensland Macroeconomic model (QMEM), a Computable General Equilibrium (CGE) Model and a series of hierarchically balanced regional and state wide input-output models which are used primarily as preliminary stages in the development of the other models. All of these are operated within the Office of Economic and Statistical Research. This office is currently developing a fourth model, a multi-regional, multi-regional input-output/econometric model in conjunction with the Economics Department of the University of Queensland.

The central role taken by Treasury in constructing and maintaining QMEM is further indication of the importance of the public sector in applied economic analysis and the importance of the interaction between the public sector and Queensland universities.

A HISTORY OF MACROECONOMETRIC MODELLING IN QUEENSLAND TREASURY

Queensland Treasury has long believed that economic modelling plays an important role in forecasting and policy advice. The development of the first State econometric model (QSM) commenced in 1988 within the Economics Department at James Cook University and was undertaken by Dr Peter Crossman, now Government Statistician and head of the newly formed Office of Economic and Statistical Research. Queensland Treasury actively supported this project, although, until 1991, the model was developed and maintained at James Cook University. In 1991, the project became part of Queensland Treasury and formed the core activity of the Econometrics Branch within the Economics Division and later was central to the operations of the Macroeconomic Branch in that Division. Dr Crossman continued the research and development of QSM in Treasury and initiated the recent development of the model began in September 1996, when Dr Christine Williams joined the project. Dr Williams was seconded for two years to Queensland Treasury

from Queensland University of Technology to undertake a review and revision of the most recent version of the Queensland State Model, QSM6. She has now joined Queensland Treasury as leader of the macroeconomics team within the Office of Economic and Statistical Research and has developed a new version of the model, QMEM, the Queensland Macroeconometric Model.

THE ROLE OF *QUEENSLAND STATE ACCOUNTS*

QSM was initially, in common with most macroeconometric models at the time, a Keynes-Klein type model, based on quarterly data. However, the development of its specification and estimation techniques were influenced and constrained by limited availability of data for Queensland. Quarterly data on State macroeconomic activity were not available from the Australian Bureau of Statistics (ABS) for any period prior to September quarter 1984 and even these data had major limitations, in that the ABS *State Accounts* did not incorporate interstate trade flows.

Dr Crossman addressed this limitation in the development of *Queensland State Accounts*, which have been produced by Queensland Treasury since the first edition in September 1993. The development of these accounts was pivotal to the initial development of QSM and the existence of *Queensland State Accounts* has, with the cessation of ABS Quarterly *State Accounts* in June 1998, allowed the continued modelling of State activity in Queensland. Other States have had to rely on estimates produced by consultants who do not have access to the same detailed information as is available to Queensland Treasury.

GENERAL EQUILIBRIUM MODEL

Queensland Treasury has also developed a multi-regional Computable General Equilibrium model of the Queensland economy (QGEM). The theoretical structure of QGEM is based on the Monash-MRF model developed by Monash University (Peter et. al. 1993). QGEM is particularly useful for analysing the impact of government microeconomic policy. The advantages offered by QGEM include the strong theoretical foundation and detailed specification of the inter-industry linkages and State and National government fiscal accounts. Importantly, QGEM also imposes economy-wide constraints on factor markets and government budgets. Current work on the model aims to introduce recursive dynamics to allow for industry level forecasts and the analysis of dynamic adjustment paths.

THE MACRO-ECONOMETRIC MODELS

The specification of an econometric model is integrally related to the purpose for which the model will be used. The main emphasis for QSM was for short to medium term forecasting, principally for the Budget process, and, to a lesser extent, for policy and impact analysis. This is in keeping with most Treasury models throughout the world. Time series econometric methods are the most appropriate tools to use to build to suit such purposes.

The early versions of QSM were ahead of most other econometric models in Australia and indeed in the US and Europe in their use of recent developments in

econometric methodology. All versions of QSM were estimated using the knowledge of the time series properties of the data, with non-stationarity, cointegration and later error correction models (ECM) at their core. The sophistication with which these techniques were applied has advanced as testing capabilities, such as for seasonal unit roots were developed and sufficient data were available to justify the use of these techniques.

Error correction modelling has been central to all versions of the Queensland macroeconometric models, the latest version QMEM being no exception. The use of ECMs allowed the incorporation of both economic theory and pragmatism into the modelling approach. The long run relationships within the ECM are entirely theory consistent, while the short run dynamics allow for the inclusion of more data-driven relationships, such as the nature of time lags in the relationship between the dependant and explanatory variables. This approach is illustrated in several of the papers in this edition.

Probably unique to most versions of the QSM[1] was the use of original time series data, in preference to the more commonly used seasonally adjusted data. While some of the motivation for this was pragmatic, that is, seasonally adjusted data were not readily available, the key motivation was the Wallis (1974) critique of the use of seasonally adjusted data in econometric estimation, which showed that seasonally adjusted data in time series modelling has several econometric shortcomings. For example, information may be lost unnecessarily about the nature of the relationship between variables. Filtering of data such as with seasonal adjustment may also obscure the specific time series properties of the data set.

In addition, the important role of tourism expenditure in the Queensland economy was recognised in the development of the *Queensland State Accounts*, with estimates made of key components of tourism expenditure in Queensland and by Queenslanders. The existence of these estimates has allowed the inclusion in QMEM of equations explaining five different components of tourism activity in Queensland: exports and imports of tourism services overseas; exports and imports of tourism services interstate; and intrastate tourism expenditure.

RECENT DEVELOPMENTS

The latest version of the model, QMEM, was completed by early 1998, and was used to produce the economic forecasts underpinning the Queensland State Budget 1998-99 brought down in April 1998. Further refinements have been incorporated since that time to extend the capabilities of the model, particularly for policy simulation and impact analysis.

In its current form, the model has around 29 equations and 41 identities, using information from over 150 variables to produce short to medium term forecasts of the Queensland economy. There are four key sectors in the model, which interact with each other through identities and equations:

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[1] QSM6 was the exception and used seasonally adjusted data but this was done on an experimental basis.

- the household sector, where household consumption, dwelling investment and labour supply decisions are modelled;
- the firms sector, where labour demand, investment and business output are estimated;
- the trade sector, where exports and imports of goods and services, including tourism, both overseas and interstate are explained; and
- the prices sector, where average wages and the prices of exports, imports and domestically produced goods and services are modelled.

The model has been used quite extensively over the past year, not only for budget forecasting and the mid-year review process, but also for some special projects for other government departments.

Currently, model is again being re-calibrated and, where necessary, re-estimated to incorporate the recent changes in the presentation of National Accounts data by the Australian Bureau of Statistics. There are two major changes which were implemented at the end of 1998: the introduction of the new international standard for national accounts data, *System of National Accounts, 1993* (SNA93) and the rebasing of the data on a chain volume basis, as compared with the previous constant price basis. The SNA93 changes include the redefinition of several key components of the national accounts as well as a change to an accrual accounting basis for the accounts, compared with the cash accounting approach previously used. The redefinitions having a major quantitative impact on the accounts include the change in the treatment of defense expenditure. The use of accrual accounting has impacted most on *Compensation of Employees* (previously referred to as Wages, Salaries and Supplements. Chain volume measures have changed some of the relative sizes within the accounts, by valuing the series in terms of last year's prices, rather than the more distant 1989-90 prices. Investment and import data have been most affected by this change. Chain volume measures have had a more insidious effect from the point of view of modelling in that the national accounts are no longer truly additive in chain volume terms. This is one of the challenges being faced by the Macroeconomics Research Team at present.

This special edition of Economic Analysis and Policy is designed to showcase the application of the QMEM model on issues of importance to the Queensland economy. The papers by Chan and Williams, Wildie, Williams and Williams and Hurley all centre on the QMEM model. The remaining papers by Trendle and by West make use of improved forms of input-output analysis.

In the first paper, Chan and Williams use the QMEM model to examine investment behavior in Queensland over the period 1984-1997. Central to the paper is the role of expectations in the investment cycle and the crucial role played by factors external to Queensland in shaping these expectations.

In the second paper, Trendle moves from consideration of the marco-approach to examine issues relating to the development of a multi-regional input-output model for Queensland. In this paper the difficulties of generating sufficient data, particularly in terms of reliable inter-and intra-regional trade flow data are highlighted as well as the steps developed within the Office of Economic and Statistical Research to overcome such limitations.

In the third paper, Wildie, applies the QMEM model to examine the determinants of labor demand and supply behavior in Queensland. The Queensland labour market is distinguished from the rest of Australia by a higher participation rate and a more responsive workforce to increases in economic activity (encouraged worker effect). Both factors have implications for the current drive within the state for unemployment reduction.

In the fourth paper, Williams moves from the consideration of investment to a consumption in Queensland through the estimation of a consumption function. Once again the QMEM model is used, with consumption modelled is per capita terms to avoid potential specification problems which may be associated with population growth.

In the fifth paper, Williams and Hurley specifically consider the population issue through an economic model of interstate migration. The characteristic division of the QMEM model, between Queensland and the rest of Australia is use to define net migration flows and the (logged) level of net interstate migration is used as the dependent variable within the Equation

In the final paper, West uses the QUIP model to study changes in industrial structure in the Queensland economy. The paper once again demonstrate the value of extended input-output analysis in analyzing regional specific and sub-national economies.

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